

Short communication

EMERGENT AGGREGATIONS IN SEMON'S ROCK-CLIMBING GOBY
STIPHODON SEMONI

KEITH MARTIN

Dames & Moore Pty Ltd,
P.O. Box 444 Trinity Beach, QLD 4839, AUSTRALIA
(e-mail bbnkcm@dames.com)

The gobiid genus *Stiphodon* comprises a small group of tiny, usually brightly coloured fishes which are widely distributed through Indonesia, New Guinea and various Pacific islands (Allen 1991; Kottelat *et al.* 1993). They are diadromous, spending their adult lives in the upper freshwater reaches of small coastal streams. Breeding takes place during the wet season in freshwaters, after which the larvae are flushed into the river mouths and the sea (Parenti and Thomas 1998). The post-larval fish must then travel back upstream to the rocky, torrent habitats they favour, up an elevation of 350 m (Watson 1996).

In southwestern Sumbawa, Indonesia, development of a gold/copper resource has prompted an ecological monitoring program for the local freshwater streams. Fish populations have been sampled at several sites in each of four streams on a semi-annual basis since 1996. The largest stream sampled is the Tatarloka River, with a catchment size of about 200 sq km.

During the course of regular monitoring surveys on the upper Tatarloka River on 14th April, 1999, large aggregations of Semon's Rock-climbing Goby (*Stiphodon semoni*) were observed (Figs 1-2). At numerous points along the river within a narrow gorge, thousands of individuals of this species were found to have climbed right out of the water and were clinging on to vertical, wet rock faces. Massive schools were also observed in the water, and many individuals were observed to climb out to join the emergent fish. The fish climbed the rock faces as high as the wash line, which was up to 40 cm in some areas. There, they were observed to

cling to the rocks and slowly crawl in the direction of any wash current. When still, they appeared to be feeding, by scraping the wet rock surface. Fukui (1979) described in detail the manner in which the related *Sicyopterus japonicus* climbed vertical surfaces in Japanese rivers, using the pelvic disk and fleshy jaws as "suction cups".

Densities of the *Stiphodon* aggregations were recorded by counting the number of individuals occupying 10 x 10 centimetre areas at several sites. From these data, the average densities of individuals on the rock faces were calculated at about 4,000 per m², to a maximum of 10,000 per m². The largest area covered was over 2 m² on one rock face.

The timing of this occurrence is significant. Early April is usually the beginning of the dry season in Sumbawa, but in 1999, the wet season was prolonged and for several days before and following the observations, storms and heavy rain were experienced in the catchment. Only one hour after the above observations were made, a storm event occurred and the water level at the site rose by two metres in half an hour.

It is suggested that these aggregations consisted of post-larval fish in the process of an annual, post wet season migration upstream from the estuary, which is some 10 km away. Disrupted by flooding events in a constricted section of the river, and unable to swim upstream against the strong current, the fish were forced to escape by climbing out of the water. All individuals were noted to be smaller than the regular adult size (up to 45 mm standard length) for this species, and all were dull brown in appearance. These observations suggest that the fish

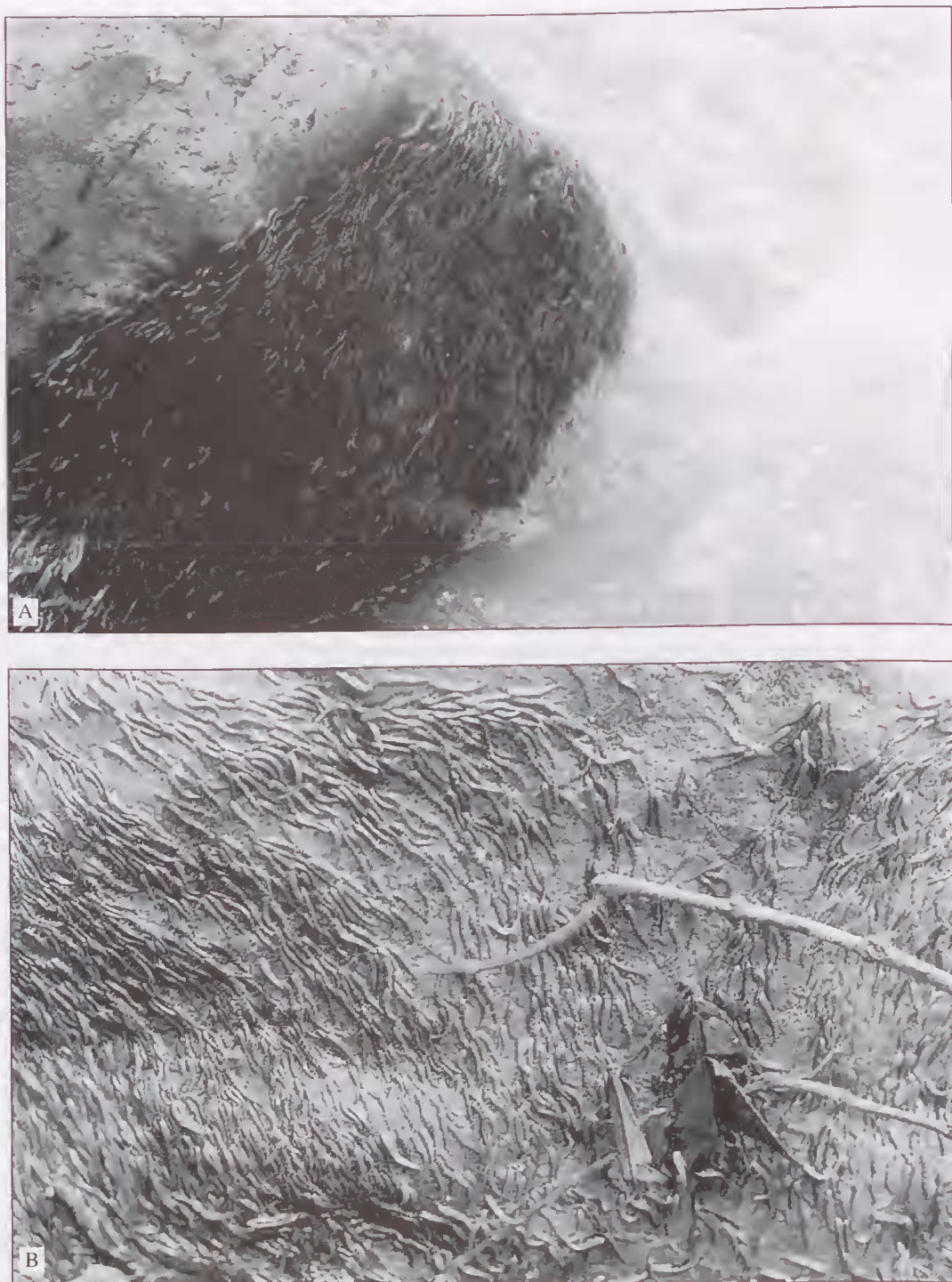


Fig. 1. A, aggregation of *Stiphodon semoni* gobies on an exposed rock face; B, detail.

were immature, as adult fish, especially the males, are brightly coloured with iridescent green or blue stripes (Watson 1996).

Stiphodon semoni is an abundant species throughout the study area, and instream mass migrations have been observed on one other occasion during the monitoring surveys, also in April but in a different river system. "Rock-climbing" gobies of the genera *Stiphodon*, *Sicyopterus*, *Sicopus* and *Rhyacichthys* dominate these upstream torrent habitats. These small fishes are especially adapted to life in the steep, boulder strewn coastal streams of the study area.

During normal dry season conditions in the study area, *Stiphodon* gobies prefer relatively level, shallow (<0.5 m), rocky or gravelly sections of the stream with a moderate flow. Density studies on these gobies under normal conditions indicate average abundances of 7-18 fish per m² of substrate, with over one hundred per m² observed on some plots. Goby densities were found to be significantly correlated to open, sunny locations, boulder or cobble substrates, and areas of moderate leaf litter cover. Water quality in the Tatarloka River is high and there is no human habitation or disturbance in the area. Generally, upstream sites along the river have a high pH (7.5-8.3), high dissolved oxygen (typically 80-90%), and a low conductivity (usually <300 µs). The waters are generally very clear and warm (25°-30° C).

The observed emergent aggregating behaviour illustrates the amazing ability and resilience of these tiny fishes to cope with extreme natural conditions. It demonstrates

that these fish, like most diadromous species in the area, have a regular requirement to undertake long and sometimes difficult migrations up and down these streams at certain times of the year.

ACKNOWLEDGMENTS

The aquatic monitoring program is one of a number of environmental studies being undertaken by PT. Newmont Nusa Tenggara in southwestern Sumbawa. The aggregation photographs were taken by Muhamad Yani. Helen Larson reviewed the draft and provided comments and additional references.

REFERENCES

- Allen, G.R. 1991. *Field guide to the freshwater fishes of New Guinea*. Publication No. 9, Christensen Research Institute: Madang.
- Fukui, S. 1979. On the rock-climbing behavior of the goby, *Sicyopterus japonicus*. *Japanese Journal of Ichthyology* 26(1): 84-88.
- Kottelat, M. and Whitten, A.J. 1993. *Freshwater fishes of western Indonesia and Sulawesi*. Periplus Editions, Jakarta.
- Parenti, L.R. and Thomas, K.R. 1998. Pharyngeal jaw morphology and homology in sicydiine gobies (Teleostei: Gobiidae) and allies. *Journal of Morphology* 237: 257-274.
- Watson, R.E. 1996. A review of *Stiphodon* from New Guinea and adjacent regions, with descriptions of five new species (Teleostei: Gobiidae: Sicydiinae). *Revue Française Aquariologie* 23(3-4): 113-132.

Accepted 13 October 1999